Study on the Influence of Ballistic and Diffusive Deposition Particles on the Evolution of the Surface Morphology of Thin Films

R. Alvarez[1], P. Romero-Gomez[1], J. Gil-Rostra[1], A. Palmero[1], J. Cotrino[1,2], F. Yubero[1], A. R. Gonzalez-Elipe[1]

[1] Instituto de Ciencia de Materiales de Sevilla (CSIC-US)
[2] Departamento de Física Atómica, Molecular y Nuclear (US)

The influence of ballistic and diffusive particles on the development of the surface morphology of plasma-assisted sputtered thin films is studied [1]. Ballistic particles are sputtered from the cathode and are characterized by their high directionality towards the film surface as well as by typical kinetic energies in the order of 1 eV, whereas thermal diffusive particles follow the Maxwell velocity distribution function, with typical kinetic energies in the order of 0.01 eV [2,3]. These factors influence the role of non-local surface shadowing and the surface sticking probability of the deposition particles, which, along with other fundamental mechanisms, strongly condition the development of the film morphology. In order to carry out this research, a combined theoretical and experimental approach has been followed: on one hand several thin films have been deposited in different experimental conditions which allow differentiating ballistic and diffusive contributions to the film growth, and, on the other hand, we have developed a basic Monte Carlo model of the depositions process. The comparison between experimental and theoretical results provides fundamental understanding about the influence of ballistic and diffusive particles on the development of the thin film nanostructure [4].

[1] A. Palmero, E.D. van Hattum, H. Rudolph, F.H.P.M. Habraken, Journal of Applied Physics 101(5), 053306 (2007)
[2] A. Palmero, H. Rudolph, F.H.P.M. Habraken, Applied Physics Letters 89(21), 211501 (2006)
[3] A. Palmero, H. Rudolph, F.H.P.M. Habraken, Thin Solid Films 515(2), 631 (2006)
[4] E.D. van Hattum, A. Palmero, W.M. Arnoldbik, H. Rudolph, F.H.P.M. Habraken, Applied Physics Letters 91(17), 171501 (2007)